CLI (command line interface)

# INTRODUCTION

Earlier, there was no UI for devices hence commands had to be given in order to perform any activity on the machine.

Now many devices doesn’t need GUI since there is no need for user interaction (Ex: server, backend device etc) hence CLI is still in use, over 90% of servers in internet run on Linux as it is fast, secure, free and also Non-GUI.

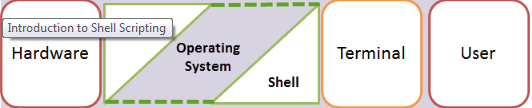
MobaXterm 🡪 is a CLI terminal emulator used to login to any Non-GUI systems using many protocols such as SSH, HTTP, FTP, SFTP, Telnet, Rsh, RDP (Remote Desktop Control), VNC (virtual network computing), Mosh (advanced SSH with added features).

Unix 🡪 developed by Bell lab, owned by them.

Linux 🡪 Linux is an free, open source OS using linux kernel.

* Linux is an UNIX clone, but developed by Linus Torvals from scratch.
* Since it is open source, libraries can be edited /added newly and redistributed. Thus each redistribution (distros) can be a new linux OS, for example:
  + Red hat Enterprise Liux
  + Ubuntu Linux
  + Linux Mint
  + Debian
  + Fedora
* Provides Virtual Terminals for concurrent usage/multitasking (i.e each user/instance can be accessed without disturbing other user) thus,

**$ Ctrl+alt+ F1** 🡪 logged into VT\_1.



Shell 🡪 A software program that accepts commands from User (in turn Terminal), processes it and shares the result back on the terminal.

Thus, shell is a command language interpreter.

Terminal 🡪 A program that runs shell. (Mainly a UI interface between Shell and user)

Kernel 🡪 Connection between hardware and software/os of the machine.

## Types of Shell

1. Bourne Shell (sh)
   1. Uses $ as prompt
   2. Suitable for scripting, programming.
2. C shell / Csh
   1. Uses % as prompt
   2. More user friendly (c based scripting commands), interactive usage (UI).

* Korn Shell (ksh) developed based on sh source code, a sandwich of sh & csh.
* Bash (Bourne again shell)

Incorporates feature from sh, csh, ksh (used in Linux, Unix OS)

## Shell Scripting

Shell scripting is writing a series of command for the shell to execute. It can combine lengthy and repetitive sequences of commands into a single and simple script, which can be stored and executed anytime. This reduces the effort required by the end user.

 Steps in creating a Shell Script:

1. **Create a file** **using** a **vi** editor(or any other editor).
2. Name the script file with **extension .sh**
3. **Start** the script with **#! /bin/sh**
4. Write some code.
5. Save the script file as filename.sh
6. For **executing** the script type **bash filename.sh**

* #! /bin/sh 🡪 the script gets directed to the bourne-shell.
* # 🡪 used to comment in the script

Shell commands:

* Functions that run & perform activity
* Case sensitive
* Refer: <http://www.sanfoundry.com/1000-linux-command-tutorials/> for all shell commands.
* Refer <https://www.guru99.com/communication-in-linux.html> for quick guide.

# **SHELL COMMANDS**

|  |  |
| --- | --- |
| **Command** | **Description with usage** |
| [cmd] –-help /  man help [cmd] / man [cmd] | To Display information of any command.  Example: $ ls –-help; 🡪 Displays information about ls command options.  Example: $ man help touch; 🡪 Displays touch options (press ‘q’ to quit)  Example: $ man mkdir; 🡪 Displays usage of mkdir command. |
| help | Displays usage of all the supported commands of CLI.  Some commands differ in CLI as different versions of Linux/unix supports different command usages. |
| apropos | Used in Unix s/m to search any word in a command’s description.  Ex: $ apropos edit;   * All the commands containing edit in their description is displayed.   Ex: $ apropos copy paste;   * All commands containing copy/paste in their description is shown. |
| pwd | Displays path of the working directory |
| l or ls | Lists all the files |
| $ ls ; 🡪 displays all the file  $ ls \*.jpg ; 🡪 displays all files ending with .jpg  $ ls JPG\*; 🡪 displays all files starting with JPG.  $ ls \*(jpg, png,mpeg); 🡪 displays all files ending with jpg/png/mpeg.  $ ls \*(jpg, png); == ls \*jpg, \*png ; == ls \*{jp,pn}g ; (all display same o/p)  $ ls j?g; 🡪 Displays file starting with ‘j’, ending with ‘g’ any single character in between.  $ ls –a; or $ ls –all ; 🡪 displays hidden file as well.  $ ls –lh; 🡪 displays files with their size, creation date, time, path of file.  $ ls –s; 🡪 displays file with their size  $ ls –lah; 🡪 displays all files (hidden as well) with their sizes.  $ ls –R; 🡪 shows all files in directory + subdirectories. |
| Conditions on naming a File/directory:   * It can contain any character but cannot have ‘/’ * If name starts with any special character (such as #$% etc) put the name in ‘ ‘ (called as quoting) or precede each special character with ‘/’ (called as escaping).   Ex: ?$file == ‘?$file’ == /?/$file | |
| mkdir XXX | To create a folder/directory. |
| $ Mkdir file\_name; 🡪creates a directory file\_name;  $ mkdir a.txt ; 🡪 creates a folder with name “a.txt” not a txt file.  So to create a file with proper format use “touch” command. |
| touch XXX | To create any file.  Ex: $ Touch a.txt; 🡪 creates a text file |
| rmdir XXX | To remove any folder/directory.  Ex: $ rmdir file\_name; |
| rm XXX  rm [option] XXX  [Option] | Remove any file;  Ex: $ rm file.txt 🡪 removes file from the directory.  Removes the file specified with some specifications.  -r, -R, --recursive: Remove directories and their contents recursively.  -i : Prompt before every removal.  -- version: Display version information, and exit.  Ex: $ rm –r file4 ; 🡪 deletes all the contents of file4. |
| Find XXX  Locate XXX | Find files/directory with their absolute path.  (similar to ls command but shows file path along with file name).  Ex: $ find sample; 🡪 displays path to reach “sample” file, files inside “sample”.  Find files with the keyword within the file  Ex: $ locate –i hello 🡪 displays all files containing “hello” word. |
| glob | Used for pattern matching of file names. |
| where XXX /  whereis XXX | To check where a particular command exists.  Ex: $ whereis ls; 🡪 o/p = C:\Program Files\Git\user\bin\ls.exe |
| tab | Tab key can be used to find out the available files in the system.  $ press Tab 🡪 all the files will be displayed.  $ c + press Tab; 🡪 all available files starting from “C” will be displayed. |
| echo XX | Prints data on console/terminal.  $ echo Hi\n 🡪 Hi\n is displayed on console  $ echo hello! Its me>>file.txt 🡪 add data (hello! Its me) into the file.txt |
| printf XX | Same as Echo but it considers \n as line break.  Ex: $ printf “hey \n hello” 🡪 output will be as below:  hey  hello |
| cp [src] [dest] | Copies file from source to destination.  $ cp C:/user/file backup; copies all files from source to backup folder |
| mv [src] [dest] | To move/rename files from source to destination.  $ mv file1.txt folder4 ; 🡪 moves file file1.txt to folder4;  $ mv file1.txt file9.txt 🡪 renames file1 as file9;  $ mv file.txt file.docx 🡪 changes file type from txt to docx; |
| diff fileX fileY | Compares filex with filey and displays all the mismatched lines b/w files.  Can only compare b/w files of same format (i.e., extension)  $ diff File1.txt File2.txt ; |
| history | Displays all the commands ran in the s/m (commands used from beginning).  $ history; 🡪 sequentially displays all the commands executed by user. |
| Ctrl + R | To search from entire shell history.  $ cltr+R;  Displays reverse-i-search, type in the command you were searching it will be displayed. |
| Consider below file structure for ‘cd’ command reference:  (parent directory) Home 🡪 Supriya (base directory) 🡪 file1 🡪document2🡪 w.txt;  🡪 user1 🡪 project1, e.txt, hello.docx  🡪 user 2 🡪 welcome, how.pdf, project2 | |
| cd | Change directory, move to base/working directory of user from anywhere in the filesystem.  Ex: your CD = document2; 🡪 $ cd ; 🡪 your CD = Supriya;  Ex: your CD= home; 🡪 $ cd ; 🡪 your CD = Supriya (base directory) |
| cd [path] | Move to the path specified only if it exists.  Your CD = file1; 🡪 $ cd document2; 🡪 moves to document2 folder.  Your CD = project1; 🡪 $ cd p ; 🡪 ERROR, no file found  Your CD= home; 🡪 $ cd Supriya/file1/document2/; 🡪 moves to diocument2 |
| cd .. | Move step-1 directory  Ex: your CD = project1; 🡪 $ cd .. ; 🡪 your CD = user1;  Ex: your CD = user2 ; 🡪 $ cd .. ; 🡪 your CD = home;  cd .. = cd /home  cd ../Supriya = cd /home/Supriya |
| cd - | To switch between last 2 recently used directories. |
| cd / | From anywhere to base directory.  Your CD = project1; cd / 🡪 your CD = Home |
| clear | Clears the CLI of all activity/commands. |
| Exit/ Ctrl + D | To logout from the machine |
| quit | To exit the terminal window without closing shell. |
| shutdown [option] [time] | Option to shut down (-h)/reboot (-r) the system.  Ex: $ shutdown –h now ; s/m shutdown now  $ shutdown –h +10; s/m shutdown after 10 minutes  $ shutdown –r now; s/m reboot now |
| ‘ “ ( ) | If mistakenly any special character is typed in shell prompt, to get back shell prompt type same characters closure as shown below.  Example1: If ‘ is typed; type ‘ again to get back shell ;  Example2: If ( is typed; type ) again to get back shell ; |
| date | Displays date and time w.r.t country  Example: $ date ; displays Thu Sep 28 09:00:01 IST 2017 |
| hostname | Displays the name of the host i.e., name logged in as. |
| Users | Displays the name of the user logged in as. |
| uname -a | Prints kernel name/hostname/kernel release number of the s/m.  $ uname ; o/p = Linux 🡪 meaning we are running on linux s/m. |
| bash --version | Gives the version, copyright, license details of bash. |
| df –h/free | Prints memory (total, used, free space) details of the server/home.  $ df –h ; or $ free |
| wc xx | Displays how many lines, words, bytes in the file.  Can be used only on file not on folder/directory  $ wc file.txt ; 🡪 o/p = 12 390 330 file.txt .  So there are 12 lines, 390 words of 330 bytes data in file.txt |
| unzip xxx  unzip –l xxx | To unzip a compressed zip file.  To display contents of zip file without unzipping it. |
| Cat [XXX] | 1. Displays contents of a file.   $ cat file.txt ; 🡪 displays content of file.txt  $ cat file1.txt file2.html file3.docx ; 🡪 displays content of all 3 files.   1. Copy and paste complete content of one file to another file.   $ cat file1.txt > file2.html ; 🡪 entire data of file2 will be deleted and pasted with file1 data.   1. Create a new file and add contents from old to new file.   $ cat file1.txt > file4.docx; 🡪 Creates a new file, file4.docx if not already present then copies data from file1.txt to file4.docx.   1. To create and append any data into the file   $ cat>file1.txt ; 🡪 create file1.txt  Now, Enter whatever data to be entered within file  $ ctrl+D to close adding data. |
| expr [xxx] | Expression commands to do any arithmetic/logical function.  $ expr 2 + 2 ; displays o/p = 4  $ expr 2 = 6 ; displays o/p = 0 cause the expression is untrue/false |
| bc | Opens Basic calculator terminal with display of license, copyright information of the software used. Can do all the arithmetic operations.  Ex: $ bc🡪 terminal opens.  Type pi = 10; r=70; a= 100;  Now type pi+r-100 🡪 o/p = -20  To come out of window use $ quit. |
| uptime | Displays the time machine with all details(login time, users, load etc)  EX: $ uptime;🡪o/p = 10:00:00 up 1 day, 10 min, 2 user, load average: 0.01, 0.1, 1  The format and data could differ between machines. |
| vim/ less/ nano/ joe/ emacs | To login and edit the file using terminal (similar to editor, but file content is displayed on terminal).  EX: $ less e.txt 🡪 opens the file e.txt in terminal, use CLI to edit/cut/rename file and save. |
| start \\IPaddress | To connect to any device (laptop) using its IP address and access it’s data.  Ex: $ start [\\100.8.19.2](file:///\\100.8.19.2) ; |
| Netstat | Network Statistics: Displays information of protocols in use, helps in monitoring incoming and outgoing connections to/from the machine.  $ netstat; 🡪 protocol, send, receive, address etc is shown   * Keeps running until it is stopped with Ctrl+C |
| Ping | To Test a connection request between a host and server.  Ex: $ ping 8.8.8.8 🡪 pings Google’s DNS server  And displays connection request time, packet and data stats.  Ex: $ ping –c3 8.8.8.8 🡪 pings Google’s DNS server 3 times.  Ex: $ ping yahoo.com 🡪 pings yahoo and returns it’s IP with data msgs.   * Keeps running until it is stopped with Ctrl+C |
| SSH XXX | SSH: Network protocol used for communicating securely over a non-secure connection.  $ SSH xx.xx.x.x; 🡪remote login to the given IP address |
| FTP XXX | FTP: Network protocol used for file transfer b/w client and server over a computer network.  $ FTP xx.xx.x.x 🡪 To login to remote FTP location |
| SFTP XXX | SFTP: Network protocol used for file transfer b/w client and server over a secured port/connection. (SFTP = SSH + FTP)  $ SFTP xx.xx.x.x 🡪 To login to remote SFTP location |
| nslookup | Shows IP address of hostname and the serving DNS server.  Ex: $ nslookup [www.google.com](http://www.google.com)   * Server: xx.xx.x.xxx 🡪 *this is DNS server address* * Address: xx.xx.xxx.x#xx 🡪 *host’s address* |
| host [URL/IP] | Provides information of the URL hosted.  Ex: $ host [google.co.in](http://www.google.co.in)   * Shows IP addresses hosted by google   Ex: $ host xx.yy.ahs.aj   * prints host name of site etc. |
| Telnet | Is a Network protocol used to connect to a remote host over unsafe connection.  $ Telnet xx.xx.x.x 🡪 Connects to the IP address remotely. |
| lsof | Lists all the open files  $ lsof 🡪 displays all the files open |
| ipconfig [XXX] | To display IP configuration of the machine only if it is windows OS.   * displays all current TCP/IP network configuration values * refreshes Dynamic Host Configuration Protocol (DHCP) * refreshes Domain Name System (DNS) settings   Ex: $ ipconfig 🡪 displays IPv4 address etc,  $ ipconfig /all 🡪 displays detailed n/w information.  $ ipconfig /renew 🡪 renews all adapters |
| netcat  nc xxxx OR  ncat xxxx | Netcat is used for any random TCP and UDP connections and listeners.  It can also be used for HTTP connection with the help of $ printf.   * It can open any TCP/UDP connection * Send UDP packets to server or receive from client. * Can listen/connent to any TCP/UDP ports * Deal with both IPv4 and IPv6, do port scanning. * $ Ctrl+D 🡪 command to close the nc Session   Ex: 1. TCP Client – Server Model (between 2 different machines)  On client (machine 1) 🡪 $ nc –l 1234 🡪 nc is listening on port 1234  On Server 🡪 (machine 2) 🡪 $ nc 127.0.0.1 1234 🡪 nc connects client and server at port 1234 successfully.  Ex: 2. TCP Client – Server Model (between same machine)  Open 2 tabs on same machine and try below commands on the tabs:  $ nc –l 2046 🡪 nc is listening on port 1234  $ nc localhost 2046 🡪 connection established at port 2048 on same machine.  Ex: 3. Using nc with printf to connect to server using HTTP  $ nc printf 'HEAD / HTTP/1.1\r\nHOST: www.google.co.in\r\n\r\n' | nc www.google.co.in 2046   * This helps to connect to Google using HTTP request and HTTP response will be displayed on the terminal.   Refer to manual page for more details ($ man help nc) |
| traceroute [domain\_name] | Used to display route/hops for traffic to reach client from server.  Ex: $ traceroute google.com 🡪 displays no of hops for google to send data back to host or vice versa. |
| tcpdump [options] | Prints out contents of packet transfer on network interface.  Need special privilege to use this tcpdump command.  Ex: $ sudo tcpdump –n host 8.8.8.8;   * Ping query, Shows IP address of host, the packet transfer between host and 8.8.8.8 (which is google’s server), request and reply time etc.,   Ex: $ sudo tcpdump –n port 53;   * DNS Query |
| wget [path of file] | Use Wget command to download files on a linux machine.  Ex: $ wget <http://www.google.com/folder1/file.zip>  Downloads above zip file in the linux machine. |
| ps ux | Displays status of all the processes running under a user.  $ ps ux 🡪 displays, user, PID, %cpu, %mem, start time, command, etc. |
| Kill  Kill PID [id value] | Used to Kill/close any process.  $ kill PID xxx 🡪 kills a process having processID (PID) xxx. |
| mail -s 'subject' to-address | To send Email to Sender.  $ mail –s “Welcome” [sender@mail.com](mailto:sender@mail.com); |
| mail -s 'sub' -c 'cc’ -b 'bcc' to-address | mail -s 'subject' -c 'cc-address' -b 'bcc-address' to-address;  To send Emails to Sender with cc, bcc list.  $ mail –s “Welcome!” –c [abc@mail.com](mailto:abc@mail.com) –b [def@kmail.com](mailto:def@kmail.com) [receiver@mail.com](mailto:receiver@mail.com) ; |
| mail -s "Subject" to-address < Filename | To send email with Attachment.  $ mail –s “Welcome Email” [receiver@mail.com](mailto:receiver@mail.com)> file.png |
| **Ownership**  **In Linux every user is assigned an account to store their data, there can be multiple users.**  User: User/owner who creates a file and has all the permissions to it.  Group: Group of people having access/permission to a set of file/folder.  Other**:** Person who hasn’t created file/folder and doesn’t belong to any group. | |
| sudo [option] [user]  adduser  userdel  passwd  groupmod  usermod  deluser  finger  lsof | Permits a user to execute a command as super user/admin.  $ sudo adduser user1 🡪 creates a new user user1, enter password etc.  $ sudo userdel –r user1 🡪 deletes a user (here user1)  $ sudo passwd –l user2 🡪 deletes password of user2 and disables account.  $ groupmod “press Tab key thrice” 🡪 displays all the groups on the machine  $ sudo usermod –a –G [group name] [user name];  Ex: $ sudo usermod –a –G groupmain user10 ; 🡪 add user10 to groupmain  $ sudo deluser [user name] [group name];  Ex: $ sudo deluser user10 groupmain;  Gives information on logged users in local and remote machine. $ finger  $ sudo lsof –I 🡪 lists all the open files running on ports. |
| tar[option][file][path]  -c  v  f  z  j  -x  -t  -r  --wildcards | Tar file 🡪 highly compressed files (compressing file size level: tar> gzip> bzip)  Creates a new tar archive file  Show tar file progress  File name type of archive file  Creates a gzip archive file  Creates a bz archive file (format = bz2 or tb2 or tbz)  $ tar –cvf f1.tar /home/folder1 🡪 f1.tar file will be created under folder1.  $ tar cvf**z** f2.tar.gz /home/folder2 🡪 creates compressed gzip file f2.tar  $ tar cvf**j** f3.tar.bz2 /home/folder3 🡪 creates highly compressed bz file f3.tar  To Untar/extract the .tar files use “**x**” in command  $ tar –xvf file1.tar /sample 🡪 unzips file1.tar in sample folder  $ tar -xvf fil2.tar.gz 🡪 unzips gzip file  $ tar -xvf fil3.tar.tbz 🡪 unzips bzip file  To Display contents of Tar file  $ tar –tvf file1.tar 🡪 all files under file1.tar will be displayed  $ tar –tvf file2.tar.gz 🡪 lists file under gzip  $ tar –tvf file3.tar.tbz 🡪 lists file under bzip  Adding files to tar file  $ tar –rvf file1.tar sample.txt 🡪 sample.txt file will be added to file1.tar  $ tar –rvf file2.tar.gz sample.txt  $ tar –rvf file3.tar.tbz sample.txt  Extract group of files selectively using pattern matching.  $ tar -xvf folder1.tar –wildcards ‘\*.php’   * All the files containing .php in their name present inside folder1.tar will be extracted/unzipped. |
| **Permissions** | |
| Read  Write  Execute | Ability to open, read and list contents of a file.  Authority to add, remove, rename files in a directory, but cannot rename, move, delete directory.  Authority to run, see and modify a .exe file  (if no permission cannot execute/run .exe file) |
| ls –l | Displays r,w,x,\_ permissions of the folder/directory  Format: -aaabbbccc |